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PHOTOGRAMMETRY IN CITY PLANNING AND OPERATIONS

by Louis A. Woodward

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PHOTOGRAMMETRY IN CITY PLANNING AND OPERATIONS

Louis A. Woodward[1]

Not so many years ago the United States was a rural nation with only a very few cities, and none of these very far from the sea or other navigable water. With the gradual change from an agricultural to an industrial state many changes have taken place. New cities have sprung up almost overnight and older cities have grown like "topsy". With the growth of huge cities have come great changes in the manner of life of the residents.

A few years ago every family, save the poorest, occupied a detached house. Next came the solid blocks of houses or row houses as they are sometimes called. This was closely followed by apartment houses where individual families occupied from a single room to an entire floor of a building.

As the population of cities increased, land values rose and this caused building heights to increase. About this time the high speed electric elevator was developed which made it possible further to increase building height. All of this development increased the density of population. People lived and worked in multiple-story buildings which caused crowded conditions far beyond the expectations of the engineers and planners who laid out the streets and sidewalks.

The automotive age saw cars replace carriages which resulted in life moving at a much faster pace which completely changed conditions in cities. This improved method of transportation, as well as improved communications, enabled people to move away from the hearts of cities. It also brought people into the metropolitan areas of cities who had previously lived in rural areas. More people meant increasing demands for public services, such as water, sewer, fire, and police protection. Public health problems arose. Streets designed for carriages were not long suitable for cars and trucks.

City growth is almost always accompanied by growing pains, most of which are the result of inadequate planning. These growing pains become apparent in the daily addition of business and dwelling structures, in the overcrowding of schools, and in the ever increasing demands for public services.

In the beginning most cities enjoyed the beauties of a peaceful rural setting. A few stores, a Church, perhaps a school, and a score or more of dwellings clustered at a crossroad, along a railroad or beside a river. Services such as cities must now provide to assure the welfare of their citizens were notably lacking. When a city is small the problems of sewer extensions, water, and sewage disposal plants, new bridges, or the widening of streets, are usually met by appropriating limited tax funds or issuing general revenue bonds. By this piece-meal procedure the stage is set for future trouble due to the lack of long-range planning. The serious consequences of insufficient planning and foresight are now increasingly evident in the historical mistakes of some of our larger and older cities.

Most cities today continue to suffer from those same growing pains, but on a larger scale. City utilities and services are too overloaded to meet the demands of fringe areas. Downtown traffic snarls drive both shopper and merchant to suburban locations where, unless advance planning has taken place,

1. Vice-President, Jack Ammann Photogrammetric Engineers, Inc.

the pattern repeats itself. Outmoded ordinances and ineffective controls in many towns and cities balk any semblance of a balanced tax structure. Poor land use causes traffic to meander and change routes through residential areas and new business and industrial installations create parking problems. Heavy trucks and buses add to traffic dangers and ruin streets which were designed for only light traffic.

To escape these hazards and inconveniences thoroughfares should carry traffic through and around cities without cutting across residential areas. Major thoroughfares should collect neighborhood and fringe traffic and carry it rapidly and safely downtown. Properly planned travel arteries and parking space enable motorists to move at will and park without delay.

Lack of adequate subdivision control, among other things, usually results in streets poorly laid out with gravel sprinkled on a poor sub-base and without adequate size water and sewer lines. Many developers would do better if the city could afford equitable refund contracts on oversized public lines or help on paving. But unless there is a plan, everyone is guessing.

There are graphic examples of what any city can become if growth is allowed to go uncontrolled and unplanned. Here are the fruits of neglect; the real challenge to businessmen. Unlike the old automobile, blighted sectors of a city cannot be discarded when they are worn out. We must rebuild and patch up the weak spots before they infect adjacent areas. Otherwise, the results of low assessed valuations and increase in fire and death rates will, in time, bankrupt a city and overtax its health areas until they, too, succumb.

Good planning and good city operation is not possible without a long range plan based on complete inventory of existing facts clearly presented in graphic form. The unhappy situation in which many cities find themselves today is to a great extent the result of inadequate maps. In most cases, numerically speaking, there are more than enough maps available but the map information is not properly coordinated and does not provide the necessary map information. It is not uncommon to find as many as half-a-dozen different maps in use in a city, the majority of which are at different scales and so distorted that even the street pattern cannot be compared. A good set of maps showing graphically all the necessary social, economic, political, and topographic features clearly presents most of the city's problems and makes coordination of all of the city's activities possible. In the past the cost of obtaining this map information has been almost prohibitive, however, through photogrammetry it is now possible to secure this much needed data at prices which cities can afford and justify.

Three basic types of maps, in addition to an aerial photographic mosaic, enlargements, and contact prints, will supply most of the map information required for efficient operation by all departments. The first basic type of map required is called an "Area Map" or "General Map" and will be at a scale somewhere between $1'' = 2000'$ and $1'' = 4000'$. This map should cover an area at least 5 miles in all directions beyond the city limits. In states where township and county planning laws have been passed this type of map should be extended a few miles beyond the township or county boundaries. This map should show main drainage systems, railroads, roads, streets, parks, schools, neighborhood shopping centers, police and fire stations, airports, and possibly a few other items. It is particularly important that this map be all on one sheet if possible, or on the fewest number of sheets possible in the event of large cities. The map should be designed and drafted to permit reproduction at smaller scales as small scale copies are necessary for many purposes. A map showing only this information can be used for a great many purposes. However, for effective use, a number of photographic linen reproductions must be made upon which special purpose data may be delineated. For example - one linen reproduction of the basic map will be used to delineate existing land

use data; another to delineate zoning data; and others for showing transportation facilities; through streets; utilities, commercial and residential development; census tracts; civilian defense; and other data. In some cases two or more of these subjects may be shown on one base. By having this necessary data all compiled on the same basic map at the same scale the relationship between the various subjects can readily be noted and general plans made for correcting existing problems and planning for a better future. The "Area" or "General" map need not be at any extremely high degree of accuracy as it is not used for accurate measurements. A tracing of a reasonably good mosaic will provide all of the accuracy necessary.

The second basic type of map required for efficient city operations is a topographic map. The Department of Public Works and Engineering have the greatest use for this type of map. These topographic maps range from 2' contours at a scale of 1" = 100' to 10' contours at a scale of 1" = 400'. For most cities a topographic map showing 5' contours at a scale of 1" = 200' provides adequate over-all information, although 1' and 2' contour maps are frequently necessary for problem areas. The various uses of this type of map dictate considerable detail and a high degree of accuracy.

Some cities make the mistake of enlarging Government quadrangle maps and attempting to use them instead of having the proper type of maps compiled. The Government quadrangle maps are very good maps and are necessary for the purpose for which they are compiled; but, they are not designed, intended, or satisfactory to meet the detailed requirements of the various departments of a city government.

Proper topographic maps are a necessity for efficient operations of the Department of Public Works and Engineering and will enable solving many of a city's problems in the office. I do not believe that any branch of the engineering profession requires a broader knowledge on so many engineering subjects or has a greater need for proper maps as does the position of City Engineer. The principal engineering subjects of which he must have a working knowledge are, water supply, transportation, construction, communication, sanitation, light and power, and, in addition, he must know considerable about finance, machinery and equipment, public relations, and law. One of the most important requirements of a city is water. Every city must have a water supply and the amount required per capita is constantly increasing. Water must be found in streams, lakes, impounded reservoirs, or wells. Maps play a very important part in finding the sources of water supply and in getting this water to the consumer. The Engineer's problem in transportation is to put the planners overall plans into effect in order that people may move from place to place rapidly and safely. This involves a knowledge of streets, roads, curbs, gutters, and sidewalks. Proper grades and elevations of streets, sidewalks, curbs, and gutters are a problem in which maps can be of tremendous value to the City Engineer. Another problem relating to transportation - is proper drainage. This involves information on run-off and the dangers from flash floods, all of which involve the size, grade, and location of storm sewers.

Generally speaking, the City Engineer is not too much involved with communications; nevertheless, he frequently becomes involved in such items as right-of-ways for highlines, cables, and micro-wave towers in order that such items will not be placed at locations to hazard or inconvenience the public. Many of these problems can be solved from an adequate set of reliable maps.

The City Engineer is continually involved in the problem of sanitation which, in many cities, is a very critical item. The engineering problem in sanitation is generally divided into four classes - namely, sanitary sewers, the disposal of sewage, the disposal of refuse, and drainage to eliminate stagnate water which might cause a nuisance. Proper maps can be very effectively used by the City Engineer in effectively working out a satisfactory solution to each of these problems.

These are only a few of the uses a City Engineer has for adequate topographic maps. A few months ago we completed the compilation of topographic maps for an area of about 350 square miles at Dallas, Texas. These maps were at a scale of 1" = 200' and the contour interval was 5'. This mapping project extended over a period of about 2 years. We have been advised by officials of the City of Dallas that the solution of one expressway problem more than saved the total cost of these maps. Photogrammetry can provide these maps rapidly and at a very reasonable price.

Engineering uses of topographic maps are by no means the entire use of topographic maps by cities as they are very effectively used by the City Plan Engineer in subdivision control and in the development and adjustment of zoning regulations, by the Building Inspector in considering building permits, and by various other departments.

The third type of map is one that is sometimes called a "Tax Map" or a "Block Map". This map will generally range in scale from 1" = 50' to 1" =200'. There is no agreement among city officials regarding the accuracy of this map or the detail to be shown. Some City officials are of the opinion that the map should be a diagram-type map although it must be compiled to a reasonable degree of accuracy, while others insist it should be extremely accurate. This map, like the "Area" or "General" map, is used for a wide variety of purposes. The information shown on this base map are the legal width of streets and alleys, railroads, property boundaries, and the lot and block numbers. The lot and block numbers are keyed to a card file which shows property ownership, dimensions, improvements, and other data as may be required.

Photographic linen reproductions on the "Tax" or "Block" map are used to show utilities such as water mains, gas lines, electric lines, sewers, and other information in congested areas. By all map users in the city using the same basic map, operations are easily coordinated. On the other hand, if gas mains are shown at one scale and water mains at another it is almost impossible for any coordination between these two features.

Current aerial photography is one of the most important items of all maps as it is through this photography that all of the various types of maps and map information may be kept up-to-date. In some cities new air photography is a well justified expenditure every two years, however, in other cities that are developing more slowly new photography is not required in less than 5 to 10 years. The new photography and mosaics are used for a wide variety of purposes in addition to bringing the three basic maps up-to-date. For example, it is extremely important that cities maintain a rate of growth statistics. By making a house count within each census tract it is easily possible to apply the necessary factors and to determine growth data for each census tract from each new set of photographs.

By having up-to-date map information available, a city's future problems are at the fingertips of the Administrators, Planners, and Engineers and adequate provisions can be made currently to save millions of dollars in future operations and development. As an example of this, if a developer files a new subdivision plan which shows a sanitary sewer only sufficient to provide for the proposed subdivision and the city's general plan calls for further development in this area, appropriate arrangements can be made with the developer to install larger main sewers in order to provide for subsequent development. This same item applies to storm sewers, gas mains, electric transmission lines, street widths, and many other items.

Without proper maps, public works, engineering, tax, zoning administration, subdivision control, and, in fact, most of a city's functions pay heavily for accumulative errors. Many cities are faced with the dilemma of either allowing fringe satellite developments to incorporate as a separate municipality or

annex them and shoulder years of financial burden. In the United States last year 402 municipalities annexed additional territories totaling almost 300 square miles. Mr. John C. Bollens, in the 1953 Municipal Year Book, pointed out that most municipalities provide municipal services that are inadequate or entirely lacking in these newly annexed areas. It is of paramount importance that city and county governments have the necessary maps upon which current and long-range urban and rural problems can be accurately and systematically studied in order that the maximum possible service may be provided with each tax dollar. Through the use of good maps and current statistical reports government can better serve the public. Civic clubs, Parent Teachers Associations, Chambers of Commerce, and other groups can better understand programs if planned on good maps and will therefore support bond issues for needed public improvements.

A City Official from a city in Europe recently told me that only cities as wealthy as those in the United States can afford to operate without detailed plans and adequate maps.

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